

## **COMBINATION WRITING INSTRUMENT**

### **FIELD OF THE INVENTION**

[0001] The present invention relates to a writing instrument and, in particular, a writing instrument having at least two writing elements that are axially moveable with respect to one another, and more particularly, with one writing element being disposed  
5 within the other writing element. The present invention also relates to improvements to filler-type writing instruments.

### **BACKGROUND OF THE INVENTION**

[0002] Writing instruments having multiple writing elements are well known in the art. For the most part, these writing instruments have a plurality of writing elements  
10 disposed adjacent (side-by-side) to one another within a pen barrel. Prior art writing instruments have combined a variety of types of writing elements, including ball point pens, highlighters, and markers, in various combinations (*e.g.*, all the same type, one of each, or more than one of more than one type). A drive mechanism is actuated to displace the writing tip of one of the writing elements to a position outside the barrel. In some cases,  
15 one writing instrument is already in a fixed position outside the barrel and the second writing element is moveable.

[0003] In order for the moveable writing element to be used for writing, it must be projected out of the barrel past the distal-most portion of the fixed writing element. In other known writing instruments, the distal-most portion of the moveable writing element – when  
20 fully projected – is in the same plane as the distal-most portion of the fixed writing element. Therefore, the two writing elements can produce two lines, or a line with a thickness greater than either writing element individually. Also, if the writing elements are supplied by two different writing mediums, two different lines can be produced.

[0004] The disadvantage of side-by-side construction is that the diameter of the pen  
25 barrel housing the writing elements must be greater than the diameter of a standard pen having only one writing element. To create a more compact writing implement, prior art devices have mounted the writing elements coaxially (*i.e.*, one writing element disposed

within another writing element), whereby the inner writing element is moveable relative to the outer writing element.

[0005] Various compact, multiple-writing-element writing instruments currently exist. These instruments have several distinguishing features. For example, U.S. Patent 5,026,189, filed on April 5, 1990, and issued to George Keil on June 25, 1991, discloses a writing instrument having a pen barrel with two writing elements coaxially mounted therein. The inner writing element moves axially relative to the outer writing element. In one embodiment, each writing element has its own ink reservoir. The driving mechanism for moving the inner writing element relative to the outer writing element, however, is located towards the center of the pen barrel. Consequently, the writing tips must be separated from their respective ink reservoirs. The construction of such a writing instrument thus is complex and difficult to assemble en mass. Other prior art devices have inner and outer writing elements, which share a common ink reservoir. Such a configuration is undesirable if an operator wants to use different types of writing mediums.

## 15 **SUMMARY OF THE INVENTION**

[0006] A writing instrument in accordance with one aspect of the present invention has an outer barrel housing an inner writing element coaxially mounted within an outer writing element. The writing elements are axially moveable with respect to each other. Preferably, the inner writing element is made of a material chosen for its rigidity and resistance to corrosion.

[0007] In order to operate the writing instrument of the present invention, at least one writing element is connected to a driving mechanism. The driving mechanism causes axial movement of one writing element with respect to the other writing element. In operation, one writing element may be fixed so that at least a portion of its writing tip remains outside the barrel, allowing the writing instrument to be used to mark a writing surface. The other writing element is axially moveable. Upon actuation of the driving mechanism, the moveable writing element is extended from the barrel so that its distal-most portion extends beyond the distal-most portion of the fixed writing element. Now, the moveable writing element can be used to mark a writing surface.

30 [0008] In accordance with another aspect of the present invention, a writing instrument is provided with a nib-type filler-type writing element that can be refilled. A

non-porous sleeve preferably covers at least a portion of the nib and/or filler of the writing element. If a filler material is used (*e.g.*, a tampon), the sleeve enables the user to handle the filler material without getting writing medium on his/her hands and/or fingers. To enable refill of the writing element, the outer barrel of the writing instrument is designed to permit access to the writing element.

[0009] The construction of a writing instrument as described herein meets the needs of modern day users of writing instruments. Such a construction allows two different writing elements (*e.g.*, pen and highlighter/marker) to be used. For example, those who edit written works can perform two independent functions – annotating and highlighting – with the same writing instrument.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0010] The present invention can be better understood by reference to the following drawings, wherein like references numerals represent like elements. The drawings are merely exemplary and the present invention is not limited to the embodiments shown.

[0011] **FIG. 1** is an elevational view of an exemplary writing instrument formed in accordance with principles of the present invention;

[0012] **FIG. 2** is a perspective view of two writing elements that may be used in a writing instrument formed in accordance with the principles of the present invention, the writing elements being shown in isolation with one writing element inserted over the other writing element;

[0013] **FIG. 3** is an exploded view of a writing instrument as in **FIG. 1**;

[0014] **FIG. 4** is a longitudinal cross-sectional view of the back barrel of a writing instrument as in **FIG. 1**;

[0015] **FIG. 5** is a longitudinal cross-sectional view of an exemplary writing nib for an outer writing element in accordance with the principles of the present invention;

[0016] **FIG. 6** is another longitudinal cross-sectional view of an exemplary writing nib for an outer writing element in accordance with the principles of the present invention;

[0017] **FIG. 7** is a cross-sectional view of an exemplary outer writing element in accordance with the principles of the present invention;

[0018] **FIG. 8** is a cross-sectional view of another exemplary outer writing element along line VII-VII of **FIG. 2**;

5 [0019] **FIG. 9** is an exploded view of an embodiment of a front barrel engaging an exemplary driving mechanism of a writing instrument formed in accordance with the principles of the present invention;

[0020] **FIG. 10** is a perspective view of another embodiment of a front barrel engaging a second exemplary driving mechanism of a writing instrument formed in  
10 accordance with the principles of the present invention;

[0021] **FIG. 11** is an exploded alternative view of components making up a third embodiment of a driving mechanism of a writing instrument;

[0022] **FIG. 12** is an exploded view of an exemplary drive mechanism and writing instrument;

15 [0023] **FIG. 13** is an exploded view of an exemplary cap that may be used on a writing instrument formed in accordance with the principles of the present invention;

[0024] **FIG. 14** is an exploded view of another exemplary cap that may be used on a writing instrument formed in accordance with the principles of the present invention;

[0025] **FIG. 15** is an exploded view of the components of an exemplary replacement  
20 mechanism; and

[0026] **FIG. 16** is a perspective view of an exemplary refill set.

### **DETAILED DESCRIPTION OF THE INVENTION**

[0027] Referring now to **FIG. 1**, exemplary writing instrument **10** formed in accordance with the principles of the present invention, has an outer barrel **12** housing inner  
25 writing element **20** and outer writing element **22**, such as illustrated in **FIG. 2**. It should be noted that the term “writing element” is not limited to a writing element in its literal sense but, instead, covers an element having any medium that can be applied to a substrate,

including glue or correction fluid. Likewise, reference to “writing” or “marking,” or other such terms, is made for the sake of convenience. The terms “writing” or “marking” are not limited to writing and marking in their literal sense but, instead should be understood to include application of other substrates such as glue or correction fluid. As illustrated in the embodiment of **FIGS. 1** and **3**, outer barrel **12** may comprise front barrel **14**, back barrel **16**, and front nose cone **23**, extending, preferably, along longitudinal axis **11**. Front and back barrel **14**, **16** may be moveably coupled together for purposes as will become apparent. Front barrel **14** is positioned over writing elements **20**, **22** at distal end **41**, and back barrel **16** is positioned over writing elements **20**, **22** at proximal end **43**. Moreover, writing instrument **10** may have a grip (not shown) on front barrel **14**, which may be made of, for example, soft rubberized paint.

**[0028]** Front and back barrel **14**, **16** can be made of the same or different materials. For example, front barrel **14** can be made of ABS (acrylonitrile butadiene styrene) and back barrel can be made of polypropylene. Various factors such as strength, ease of manufacturing, and ability to be decorated/painted (*e.g.*, ability to receive rubberized paint to form a grip) may be considered in selecting the material that may be used for front barrel **14**. Moreover, various factors such as resistance to vapor transmission or air-tightness (*i.e.*, material chosen does not allow vapor/air to flow in or out of writing instrument **10**), cost, ease of manufacturing, and lubricity (*i.e.*, smoothness; minimal to no friction for ease of moving front and back barrels **14**, **16** relative to one another) may be considered when selecting material that may be used for back barrel **16**.

**[0029]** In one embodiment of the present invention, a portion of inner writing element **20** is provided with first writing tip **30** positioned outside outer barrel **12** and available for marking operations, and outer writing element **22** is moveable from a position with second writing tip **32** substantially entirely within outer barrel **12** to a position with second writing tip **32** outside outer barrel **12**. In such a configuration, inner writing element **20** can be used to mark a surface. Conversely, in another embodiment, a portion of outer writing element **22** may be fixed and inner writing element **20** may be moveable from a position with writing tip **30** substantially entirely within outer barrel **12** to a position with writing tip **30** outside outer barrel **12**. In yet another embodiment, both writing elements **20**, **22** may be moveable from a position with a respective writing tip substantially entirely within outer barrel **12** to a position with a respective writing tip outside outer barrel **12**.

[0030] Exemplary relative positioning and construction of writing elements **20, 22** may be appreciated with reference to **FIG. 2**, in which exemplary writing elements **20, 22** are shown co-axially mounted. This configuration, however, is not necessarily indicative of the position of writing elements **20, 22** within outer barrel **12**. Inner writing element **20** has a smaller outer diameter dimension than inner axial passage **24** of outer writing element **22** so that inner writing element **20** can fit within inner axial passage **24** of outer writing element **20**. Thus, as shown by arrow **26**, writing elements **20, 22** are capable of axial movement with respect to each other.

[0031] Inner writing element **20** can be a highlighter, marker, ball point pen, roller ball pen, felt-tipped pen, fountain pen, or any other type of writing element using a fluid-based writing medium. In other embodiments, inner writing element **20** can be a pencil, stylus, chalk, charcoal, lead, or any other type of writing element using a solid-based writing medium. These examples are merely illustrative and the present invention is not limited thereto. It will be appreciated that the term “writing medium” is used for the sake of convenience and is not intended to limit the “writing element” to specifically “writing” operations, as the invention is not limited to “writing” operations, as noted above.

[0032] In the embodiment of **FIG. 2**, inner writing element **20** is formed from two distinct members – first writing tip **30** and first writing medium reservoir **28**. It should be appreciated, however, that writing tip **30** and first writing medium reservoir **28** can be one unitary, monolithic piece. In a preferred embodiment, first writing tip **30** of inner writing element **20** is in direct operative contact with first writing medium reservoir **28** when a fluid-based writing medium is used.

[0033] First writing medium reservoir **28** can be a writing medium tube or ink tube (*i.e.*, hollow tube capable of holding ink), such as those known in the art. Unlike a tampon, which is also generally known in the art, the writing medium tube has no filler material for holding writing medium. Nonetheless, the first writing medium reservoir **28** can also be tampon or filler-type reservoir (not shown) – *e.g.*, filler material saturated with marking medium.

[0034] In the embodiment of **FIG. 2**, outer writing element **22** has an inner axial passage **24** therethrough – preferably through second writing tip **32** and second writing medium reservoir **34**. Second writing medium reservoir **34** preferably is a filler-type reservoir, such as a filler material saturated with marking medium. A filler-type reservoir

facilitates passage of another writing element or writing medium reservoir therethrough. Second writing tip 32 preferably is formed and configured to have a wall thickness thick enough to permit formation of an inner axial passage 24 therethrough without collapsing during writing. Also, second writing tip 32 should be formed so that a consistent line may be drawn each time it is used.

[0035] In one embodiment, outer writing element 22 has two distinct members – second writing tip 32 and second writing medium reservoir 34. Moreover, second writing tip 32 may be in direct operative contact with second writing medium reservoir 34. It should be noted that second writing tip 32 and second writing medium reservoir 34 can be one unitary piece instead. Preferably, second writing tip 32 may be a nib. A nib-type element may include, but is not limited to, highlighter, marker, or felt-tipped nibs. As understood by those in the art, “nibs” are material-based writing points (*e.g.*, not metal), such as porous material (*e.g.*, plastics), or felt or synthetic tips or points, in contrast with ball points or roller balls. Such nibs are typically relatively wider than other writing tips, and are not used for fine, detailed writing, and may be chiseled to permit marking of wide lines. As a nib, second writing tip 32 may be made of, for example, sintered polyethylene powder or polyester fibers, having a porosity of approximately 50%, such as sold by Porex Products, of Fairburn, Georgia. The nib can also be made of acrylic or polyamide (*e.g.*, Nylon) fibers having a porosity of approximately 60%; however, a porosity as low as approximately 50% or as high as approximately 70% may also be used. A polyester fiber nib, such as sold by Teibow or Aubex (both of Japan) may be used, instead, to provide a potentially longer cap-off time (*i.e.*, allowing reduction in evaporation of writing medium). The fiber density of the nib can be as low as approximately 0.1 gr/cm<sup>3</sup> or as high as approximately 0.3 gr/cm<sup>3</sup>. Moreover, the density may vary, if desired, along the longitudinal axis. For instance, a higher density at the writing end may be desirable to prevent wobble. It should be noted, however, that while a lower density may be better for immediate ink flow (*i.e.*, the initial ink flow at about the time the writing element contacts a writing surface), it is not necessarily better for total ink flow (*i.e.*, the ink flow over the entire time the writing element is in use). Nevertheless, both wobble and ink flow can be taken into consideration when deciding on the density of the nib material. Moreover, various factors, such as cost, strength, rigidity, density, porosity, chemical stability (*e.g.*, resistance to corrosion or break-down of writing medium or components in contact with

writing medium), amount of time for the nib material to dry out, and ease of manufacturing may be considered when selecting materials that may be used for the nib.

[0036] As illustrated in both **FIGS. 5** and **6**, distal nib portion **33** may have different profiles. For example, distal nib portion **33** can be angular or straight. The angle **35**  
5 between a writing surface (not shown) and distal nib portion **33** is known as the angle of the chisel, which can be any angle typically approximately more than  $0^\circ$  or typically approximately less than  $90^\circ$  ( $0^\circ$  forming a straight distal nib portion **33**, as illustrated in **FIG. 5**, and  $90^\circ$  forming a flat distal nib portion **32** (not shown)). A preferred exemplary angle of distal nib portion **33** is approximately  $30^\circ$ . Moreover, second writing tip **32** may  
10 have a cross-section that is round, square, conical, frustroconical, etc. Such profiles and cross-sections are only illustrative and do not limit the range of possible profiles and/or cross-sections. Preferably, distal nib portion **33** is shaped and configured (*e.g.*, by selecting an appropriate angle and thickness) to permit uniform marking without a “railroad” effect such as two lines with no marking therebetween.

15 [0037] As shown in **FIGS. 5** and **6**, second writing tip **32** can have various connection components. For example, second writing tip **32** may have one or more prongs **40** extending therefrom to engage second writing medium reservoir **34**. In another embodiment, second writing tip **32** may use open-ended cylinder **42** for engaging second writing medium reservoir **34**.

20 [0038] In the embodiments, shown in **FIGS. 7** and **8**, at least a portion of outer writing element **22** may have a circular cross-section **49** or non-circular (*e.g.*, oval) cross-section **50**, and inner diameter **54**, **56** (respectively) of outer writing element **22** has a circular cross-section. In another embodiment, not shown, at least a portion of inner writing element **20** may have a non-circular (*e.g.*, oval) cross-section. The cross-section of outer  
25 writing element **22** may be selected to provide improved resistance to flexure or wobble (*i.e.*, the bend of a writing element that occurs during writing) as compared to a writing element with an inner axial passage and a circular cross-section. A circular inner diameter **54**, **56** allows for ease in axial movement of writing elements **20**, **22** with respect to each other. Nevertheless, in another embodiment, inner diameter **54**, **56** may be oval or another  
30 shape.

[0039] While one reservoir can be used to supply writing medium to both writing elements **20**, **22**, it is desirable for second writing medium reservoir **34** to be separate and



distinct from first writing medium reservoir **28**. In this way, reservoirs **28, 34** can contain different writing mediums or exhibit different characteristics, such as different colors. To facilitate insertion of inner writing element **20** through outer writing element **22**, second writing medium reservoir **34** preferably is a tampon having a filler material (not shown) for holding writing medium. The filler may be made of a material such as polyester, acrylic, acetate, and may have a porosity of approximately 80% and a fiber density of approximately 0.18 gr/cm<sup>3</sup>. The porosity, however, can be as low as approximately 75% or can be as high as approximately 95%, and the fiber density can be as low as approximately 0.16 gr/cm<sup>3</sup> or as high as approximately 0.2 gr/cm<sup>3</sup>. Specifically, the filler may comprise polyester, acrylic, or acetate fibers -- such as available from De Martini SPA (Via Santuario d'Oropa, Italy) or Filtrona (London, England) -- or a bicomponent fiber (*e.g.*, containing both polypropylene and polyethylene), such as available from Filtrona. Various factors such as cost, density, porosity, chemical stability, amount of time for the filler material to dry out, and ease of manufacturing may be considered when selecting materials that may be used for the filler. Second writing medium reservoir **34** may, however, also be filler-less -- similar to a writing medium tube. In one embodiment, the outer writing element can be a highlighter or marker. But, other writing elements may be used instead.

**[0040]** It should be noted that first and second writing medium reservoirs **28, 34** may be selected to have a writing capacity not significantly lower than that of a writing instrument with a single writing element having the same type of writing medium reservoir. For example, if inner writing element **20** is a ball point pen and outer writing element **22** is a highlighter, inner writing element **20** and outer writing element **22** preferably have the same writing capacity as a standard ball-point and a standard highlighter, respectively. A ballpoint pen according to current industry standards can draw a line approximately 1800 meters in length; a highlighter according to current industry standards can draw a line approximately 120 meters in length. Because outer writing element **22** loses valuable space to inner axial passage **24**, such a requirement affects the maximum desirable outer diameter of outer writing element **22**, and consequently, the maximum desirable outer diameter of writing instrument **10**. The writing capacity may be optimized while keeping the reservoirs within the desired size limitations by manipulating various factors, such as the combination of materials making up the outer writing element, the wall thicknesses of the elements, and overall dimensions of the pen. Based on average usage of ball point pen and highlighters, a writing capacity ratio of approximately 10:1 is desirable -- *i.e.*, preferably, writing

instrument **10** provides approximately 10 meters of ball point pen line for every approximately 1 meter of highlighter line. It will be appreciated that the desired reservoir capacity may be affected by the desired outer diameter and/or length of the finished writing instrument, and other such factors appreciated by those of skill in the art.

5    **[0041]**           In order to operate writing instrument **10**, it is desirable to have a driving mechanism operatively connected to at least one writing element **20, 22** for moving the at least one writing element **20, 22** with respect to the other writing element **20, 22**. The driving mechanism can be actuated by moving at least a portion of or another component coupled to the driving mechanism. Upon actuation of the driving mechanism, a desired  
10   writing element is extended into a use position.

**[0042]**           Exemplary driving mechanism **60**, illustrated in **FIG. 9**, includes two driving components -- a mobile, female cam **62** and an axially stationary male cam **64**. It will be appreciated that interactions of various components of driving mechanism **60** with respect to components of writing instrument **10** are applicable to other driving mechanism  
15   embodiments described herein. Mobile cam **62** can be made of polyamide (*e.g.*, Nylon) or polyacetal (*e.g.*, Delrin), and male cam **64** can be made of polyacetal (*e.g.*, Delrin). However, other materials can be used to make mobile cam **62** and male cam **64**. Various factors such as strength, rigidity, and lubricity (*i.e.*, smoothness) may be considered when selecting materials that may be used for cams **62** and **64**. In general, one writing element  
20   **20, 22** may be coupled to mobile cam **62** and the other writing element **20, 22** can be coupled to male cam **64**, as described in further detail below. Male cam **64** can be inserted in bore **63** at proximal end **65** of mobile cam **62**. While other methods of insertion are possible, in the illustrated configuration of cams **62, 64**, insertion may be accomplished by inserting male cam **64** into bore **63** at an angle (*e.g.*, approximately 35° to approximately  
25   45°) and then straightening male cam **64** as it is further inserted into mobile cam **62**. Male cam **64** has pin **68**, which can be fitted into helical cam slot **66** of mobile cam **62**.

**[0043]**           In one embodiment of the present invention, driving mechanism **60** operates to move outer writing element **22** with respect to inner writing element **20**. Inner writing element **20** may be fixed with respect to outer barrel **12**, or may be arranged for axial  
30   movement as well. In such embodiment, outer writing element **22** can be operatively coupled to mobile cam **62** and inner writing element **20** may be coupled to male cam **64** or outer barrel **12**. Outer writing element **22** can be held by longitudinal ribs (not shown) in mobile cam **62**. For example, if outer writing element **22** comprises a tampon, the

longitudinal ribs can cut into the tampon and/or filler material. Proximal end 73 (**FIG. 2**) of inner writing element 20 can be inserted into a bore (not shown) in male cam 64 or may be coupled to outer barrel 12 in another manner to permit axial movement with respect to outer writing element 22. Inner writing element 20 may be arranged in male cam 64 so that  
5 proximal end 73 of inner writing element 20 does not extend past male cam 64.

[0044] Furthermore, a spring (not shown) can be positioned around second writing tip 32 between shoulder 37 (**FIGS. 5 and 6**) of second writing tip 32 and front nose cone 23. Thus, outer writing element 22 can be pushed back into mobile cam 62. And, loosening and/or separation of outer writing element 22 and mobile cams 62 is prevented, for  
10 example, when writing instrument 10 falls/drops and outer writing element 22 hits a surface (e.g., a floor, table, etc.). Various factors such as strength and chemical stability can be considered when selecting the material to be used for the spring. For instance, the spring can be made of 316 stainless steel or any other suitable material. Moreover, the spring should be flexible enough to allow for operation of driving mechanism 60, while being  
15 strong enough to hold outer writing element 22 in mobile cam 62. Additionally, there may be an O-ring (not shown) around second writing tip 32 between second writing tip 32 and front nose cone 23. Such a construction could prevent/reduce the evaporation of writing medium.

[0045] In one embodiment, male cam 64 may be fixed to back barrel 16 so that rotation of back barrel 16 causes rotation of male cam 64 (preferably generally  
20 corresponding to the rotation of back barrel 16) without causing axial movement of male cam 64. While male cam 64 can be fixed to back barrel 16 in numerous ways, in the embodiment of **FIG. 9**, insertion member 70 can be press-fitted into inner receiving member 29 (**FIG. 4**). Engaging flats 169 may be provided on male cam 64 to engage back barrel receiving flats 69 (**FIG. 4**). As described in greater detail below, **FIG. 15** illustrates  
25 another embodiment in which a male cam 364 is fixed to back barrel 316 by engaging protrusions 385 in notches 386, and by engaging flats 369 in back barrel receiving flats 391. Mobile cam 62 is free to move with respect to back barrel 16. Mobile cam 62 is also free to move axially, but not rotationally, with respect to front barrel 14.

[0046] In operation, rotation of back barrel 16 (or any other component coupled to  
30 driving mechanism 60) causes rotation of male cam 64 (preferably generally corresponding to the rotation of back barrel 16) and, consequently, rotation of pin 68 in cam slot 66. This results in axial movement of mobile cam 62, and corresponding axial movement of one writing element 20, 22 with respect to the other writing element 20, 22. Thus, if mobile

cam 62 and male cam 64 are moved axially with respect to each other, the writing elements 20, 22 respectively coupled thereto also move axially with respect to each other. Cam slot 66 may terminate in locking notches 67 or the like, in which pin 68 may be disposed to prevent further rotation of male cam 64. Locking notches 67 are extensions of cam slot 66 extending substantially perpendicular to longitudinal axis 11 (FIG. 1). Thus, locking notches 67 may retain moveable writing element 20, 22 in an extended or a retracted position. Male cam 64 also may have a radially outwardly extending stopping section, such as in the form of stopping element 72, which effectively increases the outer diameter of male cam 64, thereby preventing male cam 64 from moving too far into mobile cam 62 once proximal end 65 contacts the stopping element 72. However, it is possible that pin 68 might reach the end of slot 66 at substantially the same time that stopping element 72 contacts mobile cam 62. When pin 68 reaches the end of slot 66 or stopping element 72 contacts proximal end 65 of mobile cam 62, back barrel 16 can be turned no further, so that the writing element 20, 22 that is being moved is fully extended and its distal end extends beyond (or in the same plane as, if desired) the distal end of the fixed writing member 20, 22.

[0047] To enable movement of inner and outer writing instruments 20, 22 with respect to each other, driving mechanism 60 may be moveably coupled to front barrel 14. As shown in FIG. 9, mobile cam 62 may have two prongs 173, 174, which engage corresponding front barrel prongs 175, 176, such that mobile cam 62 can move axially, but not rotationally, with respect to front barrel 14. Prongs 173, 174 and 175, 176 may be made of the same material as cam 62 and front barrel 14, respectively. Various factors such as rigidity, strength, and ease of manufacturing may be considered when selecting material to be used for prongs 173, 174, 175 and 176. It will be appreciated that other numbers and configurations of prongs are within the scope of the invention. For example, mobile cam 62 may have a single prong engaging a single prong receiving structure (not shown) of front barrel 14. Alternatively, front barrel 14 may have a single prong engaging a single prong receiving structure (not shown) of mobile cam 62. Moreover, for the driving means 60 illustrated in FIG. 9, any means of attaching mobile cam 62 to front barrel 14 may be used. Preferably, the configuration of the driving mechanism at least allows movement of mobile cam 62 along the axis of front barrel 14.

[0048] In the embodiment of FIG. 9, prongs 173, 174 on mobile cam 62 can be provided with guides 177, 178, respectively. Rail members 179, 180 are provided on front

barrel 14, such as on barrel prongs 175, 176. Guides 177 may engage rail members 179 and guides 178 may engage rail members 180 such that mobile cam 62 can move axially, but not rotationally, with respect to front barrel 14. Upon rotation of back barrel 16, male cam 64 rotates to move mobile cam 62 axially with respect to front barrel 14 in a distal or proximal direction. Consequently, guides 177, 178 move along rail members 179, 180. Prongs 173, 174, 175 and 176 can be positioned between second writing medium reservoir 34 (e.g., tampon) and outer barrel 12. Thus, prongs 173, 174 and 175, 176 will not disengage from one another and possibly break. It will be appreciated that configurations of mating elements other than those illustrated, but formed to effect movement of mobile cam 62, are within the scope of the present invention.

[0049] FIG. 10 illustrates an alternative prong mechanism. Driving mechanism 160 of FIG. 10 is similar to driving mechanism 60 of FIG. 9. As shown in FIG. 10, mobile cam 162 may have two prongs 273, 274, which engage corresponding front barrel prongs 275, 276, such that mobile cam 162 can move axially, but not rotationally, with respect to front barrel 14. Prongs 273, 274 and 275, 276 may be made of the same material as cam 162 and front barrel 14, respectively. Various factors such as rigidity, strength, and ease of manufacturing may be considered when selecting material to be used for prongs 273, 274, 275, and 276. The material used for prongs 273, 274, 275, and 276, however, should not be brittle.

[0050] If desired, engaging elements may be provided to regulate the extent of axial movement of mobile cam 162. Such engaging elements may be used, for instance, to prevent over-extension of mobile cam 162. In the embodiment of FIG. 10, at least one of prongs 273, 274 on mobile cam 162 may be provided with protrusions 277, and front barrel 14 may be provided with receiving members 278, 279, such as on barrel prongs 275, 276. In the retracted position of mobile cam 162, protrusions 277 engage first group of receiving members 278 at a proximal end 281 of front barrel prongs 275, 276. Upon rotation of back barrel 16, male cam 164 rotates to move mobile cam 162 axially with respect to front barrel 14 in a distal direction 282. Consequently, protrusions 277 disengage first group of receiving members 278 and, once mobile cam 162 has moved axially to extend one of writing elements 20, 22, protrusions 277 engage second group of receiving members 279. Such engagement stops further extension of the at least one writing element 20, 22 beyond the other writing element 20, 22. It will be appreciated that configurations of engaging

elements other than those illustrated, but formed to effect movement of mobile cam 162, are within the scope of the present invention.

[0051] In an alternative embodiment illustrated in FIG. 11, exemplary driving mechanism 260 includes a mobile, female cam 262 and male cam 264. Driving mechanism 260 may work much like driving mechanism 60 or 160 to accomplish a similar result. Male cam 264 can be inserted in bore 263 at proximal end 265 of mobile cam 262. While other methods of insertion are within the scope of the present invention, insertion may be accomplished by inserting male cam 264 at an angle (*e.g.*, approximately 35° to approximately 45°) with respect to female cam 262 and then straightening male cam 264 as it is further inserted into female cam 262. Male cam 264 has pin 268, which can be fitted into helical cam slot 266 of mobile cam 262. Cam slot 266 may terminate in locking notches 267 (similar to above-described locking notches 167) or the like, in which pin 268 may be disposed to prevent further relative rotation of male cam 264 and mobile cam 262 and to prevent further axial movement of mobile cam 262. This may provide a means of locking a moveable writing element 20, 22 into an extended or retracted position. Male cam 264 also may have a stopping section, such as in the form of stopping ribs 272, which effectively increase the outer diameter of male cam 264, thereby preventing male cam 264 from moving into mobile cam 262 once proximal end 265 contacts stopping ribs 272. However, it is possible that pin 268 might reach the end of slot 266 at substantially the same time that stopping ribs 272 contact mobile cam 262. While male cam 264 can be fixed to back barrel 16 in numerous ways, insertion member 270 can be press-fitted into inner receiving member 29 (FIG. 4). Engaging flats 269 may also be provided on male cam 264 to engage back barrel receiving flats 69 (FIG. 4) to fix male cam 264 to back barrel 16.

[0052] In one embodiment of the present invention, driving mechanism 260 operates to move outer writing element 22 with respect to inner writing element 20. Inner writing element 20 may be fixed with respect to outer barrel 12, or may be arranged for axial movement as well. In such embodiment, outer writing element 22 can be operatively coupled to mobile cam 262 and inner writing element 20 may be operatively coupled to male cam 264 or outer barrel 12. Outer writing element 22 can be held in mobile cam 262 by longitudinal ribs 271 (shown in phantom in FIG. 11). For example, if outer writing element 22 comprises a tampon, ribs 271 can cut into the tampon and/or filler material. Proximal end 73 (FIG. 2) of inner writing element 20 can be inserted into a bore (not shown) in male cam 264 or may be operatively coupled to outer barrel 12 in another manner

to permit axial movement with respect to outer writing element **22**. Inner writing element **20** may be arranged in male cam **264** so that proximal end **73** of inner writing element **20** does not extend past male cam **264**.

[0053] To enable movement of inner and outer writing instruments **20**, **22** with respect to each other, driving mechanism **260** may be moveably coupled to front barrel **14**. For example, non-circular cross-section **50** (*e.g.*, oval) (**FIG. 8**) of outer writing element **22** may contact outer barrel **12**. Cross-section **50** would allow for axial, but not rotational movement of mobile cam **262** and outer writing element **22** in an embodiment where the inner surface of front barrel **12** has a non-circular cross-section as well. It should be noted, however, that any other manner of preventing rotation of mobile cam **262** with respect to front barrel **14** may be implemented as well. Thus, rotation of back barrel **16** (or a portion of outer barrel **12** connected to driving mechanism **260**) rotates male cam **264**, causing pin **268** to move in slot **266** in a helical direction. Even though mobile cam **262** may be constrained against rotational movement, mobile cam **262** can still move axially. This results in axial movement of outer writing element **22** with respect to inner writing element **20**.

[0054] **FIG. 12** shows another embodiment of a driving mechanism **460** with exemplary writing elements **20**, **22**. Driving mechanism **460** is made up of cam **402**, counter-cam **404**, and cartridge closure **406** having cam follower **408** preferably formed thereon. While cam **402** and counter-cam **404** are shown as two separate pieces, it should be noted that they can be a single, composite piece. Cam **402** and counter-cam **404** may be formed as a single piece hinged together, thus allowing cam **402** and counter-cam **404** to open like a clam shell. Cartridge closure **406** with cam follower **408** are inserted over proximal end **409** of outer writing element **22**, and may be in the form of a clam shell to facilitate such insertion. Cam **402** and/or counter-cam **404** can be closed around cartridge closure **406**. Specifically, cam follower **408** can be inserted in helical camming slot **410** (*i.e.*, the space between cam **402** and counter-cam **404**). Alternatively, cartridge closure **406** and cam follower **408** may be force-fitted into cam **402** and/or counter-cam **404**.

[0055] Cam **402**, counter-cam **404**, and inner writing element **20** may be fixed against axial and rotational movement with respect to back barrel **416**. As shown in **FIG. 12**, fixing of cam **402** and counter-cam **404** can be accomplished by the mating of longitudinal back ribs **412** in back barrel **416** and cam grooves **415** in cam **402** and counter-cam **404**. Outer writing element **22** is free to move axially, but not rotationally, along

longitudinal front ribs **420**. Since cartridge closure **406** with cam follower **408** may be fixed to outer writing element **22**, it may also be free to move axially.

[0056] The embodiment of **FIG. 12** can also have a cartridge case **418** for guiding the movement of outer writing element **22**. Cartridge case **418** may be made from  
5 polypropylene, polyethylene, nylon, or any other suitable material. Cartridge case **418** may have grooves **419** receiving longitudinal front ribs **420** of front barrel **414**. Rotation of back barrel **416** (or any portion of outer barrel **12** connected to driving mechanism **460**) rotates cam **402** and counter-cam **404** which, in turn, causes cam follower **408** to move along camming slot **410**. The movement of cam follower **408** translates to axial movement of  
10 cartridge closure **406**. Thus, while inner writing element **20** remains stationary, outer writing element **22** moves axially with respect thereto. Grooves **419** guide axial movement of outer writing element **22** by groove **419** moving along longitudinal front ribs **420**.

[0057] Driving mechanisms **60, 160, 260, 460** can be actuated by moving (*e.g.*, axially or rotatably) a component making up or coupled to driving mechanisms **60, 160,**  
15 **260, 460**, as described above. Upon actuation of any of driving mechanisms **60, 160, 260, 460**, the moveable writing element is extended from outer barrel **12** so that its distal-most portion extends beyond the distal-most portion of the fixed writing element **20, 22**. Therefore, the moveable writing element can be used to mark a surface. Thus, driving mechanisms **60, 160, 260, 460** permit selection of a desired writing element **20, 22**, with a  
20 simple operation. Driving mechanisms **60, 160, 260, 460** enable a user to use one writing element **20, 22** one at a time or even at the same time if desired.

[0058] As shown in **FIG. 3**, in an embodiment in which driving mechanisms **60, 160, 260, 460** are actuated by movement of outer barrel **12** (or a portion thereof), front barrel proximal portion **21** may be coupled to back barrel distal portion **18** so as to permit  
25 relative rotational movement of barrels **14, 16**, while inhibiting relative axial movement. To prevent front barrel **14** and back barrel **16** from separating, front barrel **14** may have external circumferential ribs **15**. Moreover, as shown in **FIG. 3**, and more clearly in **FIG. 4**, back barrel **16** may have internal circumferential ribs **17**. It is desirable that ribs **15, 17** are positioned to prevent axial movement of barrels **14, 16**, with respect to each other, while  
30 still allowing for rotational movement of barrels **14, 16** with respect to each other. To accomplish this, each external circumferential rib **15** may be positioned adjacent to an internal circumferential rib **17**. In the one embodiment, at least one external rib **15** can be



positioned between two internal ribs 17. Or, at least one internal rib 17 can be positioned between two external ribs 15. Such a configuration prevents front barrel 14 and back barrel 16 from moving apart. Additionally, an O-ring (not shown) may be positioned inside back barrel distal portion 18 (other locations are also contemplated). An O-ring can provide  
5 smooth movement of barrels 14, 16 relative to one another and help prevent evaporation of writing medium (*i.e.*, prevent writing elements 20, 22 from drying out). For instance, back barrel 16 can have a pair of internal circumferential ribs 17 with an O-ring or one circumferential rib 17 with an O-ring. The O-ring may be made of silicon rubber or any other suitable material. Various factors -- for example, ability to provide a good seal and  
10 smooth movement between front and back barrel 14, 16 -- can be considered when selecting a suitable material to be used for the O-ring. Moreover, rib 19 (FIG. 3) may be provided on front barrel proximal portion 21 to abut back barrel distal portion 18 and thus to inhibit excessive distal movement of back barrel 16. It should be noted that a writing instrument cover (for example, cap 90 or 290 shown in FIG. 13 and 14, respectively, and described in  
15 further detail below) may engage rib 19 so that the writing instrument cover is held over the distal writing end of writing instrument 10.

[0059] Exemplary driving mechanisms 60, 160, 260, 460 may be located at proximal end 43 or distal end 41 of writing instrument 10, or anywhere in between. Preferably, the driving mechanisms 60, 160, 260, 460 is located at proximal end 43 of  
20 writing instrument 10 so as not to interfere with the components and arrangement of writing elements 20, 22. Driving mechanisms 60, 160, 260, 460, or components thereof, may be directly accessible for actuation, for example, either by an opening in outer barrel 12 or by driving mechanisms 60, 160, 260, 460 not being covered by an outer barrel 12 at all. At least one writing element 20, 22 can be operatively coupled to driving mechanism 60, 160,  
25 260, 460. The other writing element 20, 22 is arranged to be movable independently of the at least one writing element connected to driving mechanism 60, 160, 260, 460, and may be connected, for example, to outer barrel 12. In another embodiment, both writing elements 20, 22 can be connected to driving mechanism 60, 160, 260, 460. It should be noted that neither writing element 20, 22 has to be directly connected to the driving mechanism 60,  
30 160, 260, 460. Preferably, there are no intermediary elements (not shown) connecting the driving mechanism 60, 160, 260, 460 to one or both writing elements 20, 22.

[0060] Returning to writing elements 20, 22, since inner writing element 20 is mounted within outer writing element 22, inner writing element 20 is further (radially) from

outer barrel 12, and, further (radially) from the distal opening in front nose cone 23 than in standard writing instruments. In one embodiment, front nose cone 23 may be made of a clear material, such as for aesthetic purposes. By using a clear material, the gap between outer writing element 22 and front nose cone 23 is not so readily apparent. Nevertheless, front nose cone 23 and, for that matter, any other part of writing instrument 10 can be made of clear material so that one can see the inner workings of writing instrument 10. Front nose cone 23 can be made of polypropylene or other plastic or polymer. The material chosen for front nose cone 23 may be selected, for example, based on cost, ease of manufacturing, and resistance to vapor transmission or air-tightness.

10 [0061] Moreover, in one embodiment, in order to allow for axial movement of writing elements 20, 22 with respect to each other, outer writing element 22 has an inner axial passage 24 (FIG. 2) that is larger than the outer diameter of inner writing element 20. Such a configuration can result in wobbling. Accordingly, it is desirable to address any resultant increased wobble. Individually, or in combination, rigidity of inner writing  
15 element 20 and the support provided by outer writing element 22 thus are preferably selected to minimize wobbling. While inner writing element 20 may obtain some support from inner axial passage 24 of outer writing element 22, outer writing element 22 may provide only minimal stabilization to counter wobbling. Therefore, it is generally desirable to exhibit care in selecting the rigidity of writing elements 20, 22.

20 [0062] Rigidity may be a function of various characteristics, such as wall thickness or material. Ideally, inner writing member 20 has an outer diameter small enough to fit within inner axial passage 24 and, at the same time, a wall thickness such that inner writing member 20 can hold a sufficient quantity of writing medium. Such factors may influence the choice of material used for inner writing element 20. The material can be metal and/or  
25 plastic. Moreover, first writing reservoir 34 can be formed from a material different from the material of writing tip 30. In one embodiment, first writing medium reservoir 34 and writing tip 30 are made of plastic. Other combinations may be used. Also, other materials presently known and those yet to be discovered may be used instead. Similarly, composite materials (*i.e.*, combination of two or more materials) may be employed.

30 [0063] Because inner writing element 20 may be in contact with outer writing element 22, it will be appreciated that it may also be desirable to select a material that is resistant to corrosion especially when the outer writing element 22 has a filler-type

reservoir. Resistance to corrosion is important because first writing medium reservoir **34** is positioned within inner axial passage **24**. If inner axial passage **24** is made of a porous material that allows writing medium contained within outer writing element **22** to penetrate therethrough, the writing medium from outer writing element **22** may come into contact with the first writing medium reservoir **28**. Over time, corrosion of first writing medium reservoir **28** could cause the writing medium within first writing medium reservoir **28** to leak into outer writing element **22** and vice versa. Furthermore, corrosion may affect the performance of writing instrument **10** because of resultant writing medium losses.

**[0064]** Additionally or alternatively, inner axial passage **24** of outer writing element **22** may have an internal sleeve (not shown), thereby reducing, if not eliminating, the concern with selection of corrosion resistant material. Such a sleeve may also be helpful in reducing, if not eliminating, wicking of writing medium from writing medium reservoir **34** outwardly from between inner axial passage **24** and inner writing element **20**. An inner sleeve may be provided in inner axial passage **24**. The inner sleeve may be made of polypropylene and have a thickness of approximately 0.5 mm; however, other materials and thickness may be used. For instance, if made of polypropylene, the inner sleeve may have a thickness of at least approximately 0.4 mm or at most approximately 1 mm. The inner sleeve may also be made of any shrinkable thermoplastic material, such as PET (polyethylene terephthalate), in which case, the thickness of the inner sleeve could be at least approximately 0.05 mm or at most approximately 0.8 mm. Various factors such as rigidity, chemical stability, and ease of manufacturing may be considered when selecting materials that may be used for the inner sleeve.

**[0065]** The minimum and maximum thicknesses of an inner sleeve formed of polypropylene are a function of the extrusion process and writing capacity, respectively. A thickness of approximately 0.4 mm is the minimum thickness which typically can be extruded. Therefore, it is possible that the minimum thickness could be less than 0.4 mm, depending on the manufacturing process and other relevant factors, as long as the sleeve is still able to perform its above-stated functions. Moreover, the maximum thickness could be greater than 1 mm. However, it will be appreciated that the use of an inner sleeve or increasing the thickness of an inner sleeve may affect various characteristics of the other components of writing instrument **10**, such as the dimensions of elements. For example, altering the dimensions of outer writing element **22** may affect the capacity of outer writing element **22** to hold writing medium. In order to maintain the capacity of outer writing

element 22 (*i.e.*, the amount of writing medium held therein), various changes to writing instrument 10 could be made, to compensate for the presences of an inner sleeve or increased thickness of the inner sleeve (*e.g.*, increasing the outer diameter or decreasing the wall thickness of outer barrel 12, or decreasing the thickness of an outer sleeve 80 discussed below).

[0066] A sleeve, or other type of coating, may also be provided on outer writing element 22 (particularly if in the form of a filler-type writing element) to prevent leakage, inadvertent marking, and/or evaporation of the writing medium therein. In prior art filler-type writing elements, the outer surface of the filler material is porous. If a user touched the tampon, he/she would get writing or marking medium on his/her hands and/or fingers. This is true even where the filler material of the tampon is surrounded by some sort of tampon wrap, which may be porous and/or have a seam (*e.g.*, seam 79 in FIG. 2) along its length. A tampon wrap, such as tampon wrap 78, may be typically designed to maintain rigidity (*i.e.*, prevent side walls of second writing medium reservoir 34 from collapsing when squeezed) and straightness (*i.e.*, allow for smooth movement of outer writing element 22 within writing instrument 10). Tampon wrap 78 may be made of polyethylene, polypropylene, polyamide (*e.g.*, Nylon), polyester, or acetate and may have a minimum thickness of approximately 0.1 mm or a maximum thickness, which can be a function of the amount of space available within writing instrument 10. Various factors such as rigidity, chemical stability, and ease of manufacturing may be considered when selecting materials to be used.

[0067] Referring now to FIG. 3, at least an outer portion of outer writing element 22 may be covered by a preferably non-porous wrap (*e.g.*, sleeve 80) to enable a user to manipulate or to handle outer writing element 22 without getting writing or marking medium on his/her hands and/or fingers. When outer writing element 22 comprises a tampon as shown in FIG. 2, at least a portion of tampon wrap 78 may be covered by sleeve 80 (FIG. 3). As shown in FIGS. 3, 5 and 6, sleeve 80 may also cover a portion of second writing tip 32 (particularly if in the form of a nib). Such a construction prevents evaporation of writing medium (because less surface area of second writing tip 32 is exposed to air) and, thus, extends the life – both shelf life and usage life – of outer writing element 22. Moreover, as illustrated in FIG. 5 and 6, sleeve 80 may also be provided over second writing tip 32 (particularly if in the form of a nib), such as to hold second writing tip 32 and second writing medium reservoir 34 together. The use of sleeve 80 allows for refill of outer writing element 22 by joining second writing tip 32 and second writing medium

reservoir **34** into a single component. However, any structure or material that holds second writing tip **32** together with second writing medium reservoir **34** is envisioned -- for example, a stainless steel or plastic peg or ring within tip **32** and/or reservoir **34**; a clip or ring crimped, squeezed, or glued around tip **32** and reservoir **34**; or adhesive, staple, or any other fastener.

[0068] Sleeve **80** may be provided over the filler material, tampon wrap **78**, and/or a nib. Sleeve **80** may be made of a shrinkable thermoplastic material -- for example, PET (polyethylene terephthalate), polyethylene polyamide (*e.g.*, Nylon), or PVC (polyvinyl chloride) -- or a polypropylene wrap. Various factors such as cost, strength, chemical stability, and ease of manufacturing may be considered when selecting material to be used for sleeve **80**. If made of polypropylene, sleeve **80** may have a thickness of approximately 0.5 mm; however, a thickness as small as approximately 0.4 mm or as large as approximately 1.0 mm may be used.

[0069] For the sake of convenience, the wrap may be heat shrinkable to facilitate assembly. Another benefit of a heat shrinkable sleeve over an injection molded sleeve is the ability to achieve a smaller thickness and, thus, a smaller diameter of writing instrument **10**. If made of PET, sleeve **80** may have a thickness of approximately 0.15 mm. The minimum thickness may be a function of the strength required to retain second writing tip **32** in second writing medium reservoir **34**; the amount of available space in writing instrument **10** to allow for free movement of the driving mechanism (*i.e.*, no binding); ability to consistently shrink to a particular wall thickness; resistance to tearing or splitting upon shrinking; and speed at which shrinking can occur. For instance, the minimum thickness can be approximately 0.05 mm. The maximum thickness is generally dictated by the maximum thickness of writing instrument **10** and may be approximately 0.8 mm.

[0070] In another embodiment, as illustrated in **FIG. 12**, cartridge case **418** -- formed of a material that prevents seepage of writing medium therethrough -- may be provided over the filler-type outer writing element **22** instead of a sleeve **80**. Sleeve **80** or cartridge case **418** may hold second writing tip **32** and second writing medium reservoir **34** together -- *i.e.*, second writing tip **32** is attached to second writing medium reservoir **34** and sleeve **80** or cartridge case **418** is positioned therearound, thereby holding these components together. Other benefits of sleeve **80** and cartridge case **418** may include: reduction in evaporation of writing medium from outer writing element **22** and added stability imparted

thereby to writing elements **20, 22**. Additionally, sleeve **80** and cartridge case **418** allow for clean and easy refill of outer writing element **22**.

[0071] Refill may also be facilitated by constructing the above-described writing instrument to permit replacement of either writing element **20, 22**. While prior art devices enable writing elements to be refilled (*e.g.*, ball point pens, roller ball pens), no prior art device has allowed for refill of a nib-type writing element, or combination nib-type writing element and pen, pencil, marker, etc. The nib-type writing element can have a filler material (*e.g.*, a tampon) holding writing medium or may be fillerless (*i.e.*, the ink is not contained in a filler material). Therefore, another feature of the present invention, independent of the above-described features, is the formation of a writing instrument with a nib-type writing element such that the nib-type writing element can be replaced when the writing medium contained therein is expended.

[0072] To enable replacement of one or both writing elements **20, 22**, outer barrel **12** preferably is formed to permit access to one or both writing elements **20, 22**. Moreover, writing elements **20, 22** are preferably removably positioned within outer barrel **12** to permit ready removal as desired. Access to writing elements **20, 22** can be at either distal end **41** or proximal end **43** of writing instrument **10**. In the embodiment of **FIG. 1** and **3**, outer barrel **12** has a removable front nose cone **23** formed to permit access to outer writing element **22**, thereby allowing removal and replacement of writing elements **20, 22**. Front nose cone **23** may have internal threads **27** to engage external thread **25** at the distal end of front barrel **14** so that front nose cone **23** can be threaded on and off front barrel **14**. Yet, another embodiment may have both a removable front nose cone **23** and a removable back end button.

[0073] **FIG. 15** illustrates another replacement mechanism. Male cam **364** can function with mobile cam **62, 162, 262, 362** (shown as mobile cam **362**) and end button **380** to form a replacement mechanism, thereby simplifying refill of writing elements **20, 22**. Male cam **364**, with mobile cam **62, 162, 262, 362** coupled thereto, can be inserted into back barrel **316**, with engaging flats **369** engaging back barrel receiving flats **69** (**FIG. 4**). End button **380** is configured to facilitate locking of male cam **364** with respect to back barrel **316**. As internal threads **382** of end button **380** are screwed onto external threads **381** of male cam **364**, end button **380** is drawn closer to back barrel **316**. Simultaneously, conical surface **383** pushes against cam inner surface **384**, thereby pressing engaging flats

369 tightly against back barrel 316 and preventing axial movement of male cam 364 with respect to back barrel 316. To prevent rotational movement of male cam 364 relative to back barrel 316 -- for example, during operation of writing instrument 10 -- and to allow for end button 380 to be screwed thereon (*i.e.*, keeping male cam 364 stationary while button 380 is being screwed on), protrusions 385 slide into notches 386 in end button 380. As end button 380 is screwed further onto external thread 381, tapered surface 389 is drawn into back barrel 316, creating a preferably air-tight fit between back barrel 316, male cam 364, and end button 380. Rotation of end button 380 onto male cam 364 stops when end button engagement surface 387 contacts back barrel engagement surface 388. Furthermore, male cam 364 may further include a sealing ring 390 to create an air-tight seal between male cam 364 and back barrel 316, thereby preventing the writing medium of writing elements 20, 22 from evaporating. Such an air-tight seal is particularly important when one or both of the writing elements carries a volatile writing medium.

[0074] Using the replacement mechanism of FIG. 15, writing elements 20, 22 can be replaced when the writing medium of writing element 20 and/or 22 is expended. FIG. 16 illustrates one example of a refill set 400, which may include writing elements 20, 22; mobile cam 362; and male cam 364. It should be noted that mobile cam 362 and/or male cam 364 can be reused while only writing elements 20, 22 are replaced.

[0075] If one of writing elements 20, 22 remains in an extended position (*i.e.*, writing tip 30 or 32 is not retractable into a position within outer barrel 12), or if at least one of writing elements 20, 22 contains a volatile writing medium, it would be desirable to cover writing element 20, 22 to evaporation of the volatile writing medium. A cap 90 as illustrated in FIG. 13 may be used. Cap 90 can be made of ABS or polypropylene (but other materials are also envisioned). Various factors such as ability to be welded or painted/decorated, resistance to vapor transmission or air-tightness, cost, and ease of manufacturing may be considered in selecting material to be used. Cap opening 94 can be placed over distal end 41 (FIG. 1) of writing instrument 10 and may be fixed thereto by engaging rib 19 on front barrel 14 (FIG. 3). However, any similar structure that adequately covers writing elements 20, 22 can be used instead of cap 90. It should be noted that a cap may be purely ornamental and/or not for the purpose of preventing drying of writing medium. That is, there may be other reasons for a cap to be placed over writing instrument 10. For instance, cap 90 may prevent breakage of first writing tip 30 or second writing tip 32. Also, cap 90 may avoid inadvertent marking resulting by either writing tip 30, 32.

[0076] If, as described above, the writing medium of at least one of writing elements 20, 22 is volatile, a vapor seal 92 preferably is provided within cap 90 to prevent evaporation of the writing medium. Vapor seal 92 can be placed within cap body 96 at a location permitting ready secure coupling to outer barrel 12 to seal writing elements 20, 22. Vapor seal 92 may be designed to seal both first writing tip 30 and second writing tip 32 by engaging distal end 93 (FIG. 3) of front nose cone 23. In another embodiment, vapor seal 92 may engage any distal portion of outer barrel 12.

[0077] While not necessary, clip 100 may also be provided on cap 90 so that writing instrument 10 may be attached to any object the user desires. Nevertheless, other attachment means may be used. Clip 100 may encircle vapor seal 92, contacting cap body 96, and resting on cap support 194. Furthermore, clip 100 can be secured to cap 90 by being positioned between cap body 96 and top cap 102. While any means of connected cap body 96 and top cap 102 is envisioned, FIG. 13 shows circumferential ribs 192 engaging circumferential ribs 190 to hold cap body 96 and top cap 102 together.

[0078] Alternatively, cap 290 as illustrated in FIG. 14 may be used. Cap 290 can be made of ABS or polypropylene (but other materials are also envisioned). Similar to cap 90, various factors such as ability to be welded or painted/decorated, resistance to vapor transmission or air-tightness, cost, and ease of manufacturing can be considered in selecting material to be used for cap 290. Cap opening 294 can be placed over distal end 41 of writing instrument 10 and may be fixed thereto by engaging rib 19 on front barrel 14 (FIG. 3). A vapor seal 292 may also be provided within cap 290 to prevent evaporation of the writing medium. Vapor seal 292 can be placed within cap body 296 at a location permitting ready secure coupling to outer barrel 12 to seal writing elements 20, 22. Vapor seal 292 may be designed to seal both first writing tip 30 and second writing tip 32 by engaging distal end 93 (FIG. 3) of front nose cone 23. In another embodiment, vapor seal 292 may engage any distal portion of outer barrel 12. Cap 290 may be formed with a vent 298 and an opening 204, which allow air to flow through cap body 296 to prevent asphyxiation if cap 290 is swallowed. A clip 200 may also be provided on cap so that writing instrument 10 may be attached to any object the user desires. Clip 200 may encircle venting means 298, contacting cap body 296. Furthermore, clip 200 can be secured to cap body 296 by being positioned between cap body 296 and top cap 202.



[0079] While the foregoing description and drawings represent the preferred embodiments of the present invention, it will be understood that various additions, modifications and substitutions may be made therein without departing from the spirit and scope of the present invention as defined in the accompanying claims. In particular, it will  
5 be clear to those skilled in the art that the present invention may be embodied in other specific forms, structures, arrangements, proportions, and with other elements, materials, and components, without departing from the spirit or essential characteristics thereof. One skilled in the art will appreciate that the invention may be used with many modifications of structure, arrangement, proportions, materials, and components and otherwise, used in the  
10 practice of the invention, which are particularly adapted to specific environments and operative requirements without departing from the principles of the present invention. The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and not limited to the foregoing description.